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SOME OBSTACLES IN THE PATH TOWARDS AN OPTIMUM DIET[1]

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WAR, by interference with agriculture and commerce, as well as by direct destruction of foods, brings on starvation and the hosts of human ailments that sprout on malnutrition. Hence, in a world-wide violence, like our present war, the ancient problems of individual and national diets requisite for health and efficiency become both a national and an international concern of nutrition experts, physicians, statesmen and captains of industry. These imperative problems compel the biologist to re-examine the known and the unknown in the field of food and fitness, food and life, food and victory, so that the obstacles in the path towards an optimum diet for optimum health may not trip us in the dark. Such re-examination of the nutritional history of man (and other mammals), past and present, reveal as of to-day much new and reliable information, much innocent ignorance, many faulty food habits and unwise individual and commercial food practices of to-day, unwise practices in the light of present knowledge and past experience. There appear to be even questionable building stones in our scientific edifice. Such dilemmas as the recent assertion by Surgeon General Dr. Thomas Parran, of the U. S. Public Health Service, that, in our own country with its abundance of excellent foods, and in times of peace, "one third of our people is getting food inadequate to maintain good health, and less than one fourth of the American people are getting a good diet." This is perplexing, especially in view of the more recent assertion (November, 1942) of Sir John

[1] Lecture before the Physiological Society of Detroit, Michigan, November 19, 1942.

Boyd Orr, director of Great Britain's Imperial Bureau of Nutrition: "There is no sign of malnutrition (in England and Scotland)." In fact, Sir Orr states that the people in England and Scotland are fed better in war than in peace, the people in the higher income brackets now eating one third less than before the war, and those with lower incomes are now provided with better foods. Whether or not the alarming assertion of Dr. Parran as to the American people and the optimistic statement of Sir Orr as to Great Britain will stand scientific scrutiny may be partly a matter of definitions. But, unfortunately these are not the only questionable stones in our edifice. We, the actual workers in the field of human health and nutrition, have, in most cases unwittingly, contributed many more.

The obstacles in the path towards an optimum diet are numerous. A good or an adequate diet may be defined as the kind and quantity of food which sustains the health and general efficiency of otherwise normal people at different ages. This is of course a rough overall estimate since we have no accurate quantitative measure either of health or of physical and mental efficiency. An inadequate diet obviously is the kind and quantity of food that induces physical or mental impairments measurable by our present methods. An optimum diet implies much more than this. It might be defined as that kind and quantity of food which permits and promotes optimum growth, optimum performance of all biologic functions, optimum resistance to disease, optimum conservation of the factors of safety and powers of repair and optimum length of life with optimum efficiency within the framework of the hereditary potentialities of the individual and the species. In enumerating and discussing some of the obstacles still in the way of securing or using such a diet for man, I wish to make it perfectly clear that the order of their listing does not in any way imply their relative importance. This we do not know. Colleagues working in the different fields will obviously rate these obstacles in very different order of importance, but this is of little significance since many of them overlap, and provided that we recognize them all as actual or possible factors.

(A) If the above definition of an optimum diet is accepted, it will be clear to most informed people that the sciences of physiology, nutrition and medicine do not to-day have sufficient knowledge to outline the components of an optimum diet. We do not know the optimum hereditary potentials of any one individual. We do not know the tissue reserves that any one starts out with at birth, nor do we have accurate measures of the depletion of these reserves until well advanced in the form of demonstrable or recognizable disease. We do not even know all about the optimum soil fertility for the production of grains, vegetables and fruit of optimum nutrition value. In experimental nutrition in animal husbandry the rate of growth, body size and body weight are usually taken as a measure of superiority of the diet within the framework of hereditary potentials and in the absence of recognizable disease. But one may question whether the height and other dimensions of man are adequate measures of an optimum diet so far as these elements are determined by the diet. I know of no evidence that the five foot ten inches individual is biologically, mentally and economically or even socially inferior to a six-footer. In some biological factors man is inferior to the gorilla, the tiger, the elephant and the horse. Yet he has survived and may some day conquer the jungle. The measure of biologic fitness of the man of to-morrow would seem to be the capacity to produce, serve and survive in the kind of environment worthwhile for man to live in. It seems probable that in this task the size and plasticity of the brain is of more significance than the length of the legs or the width of the shoulders. At any rate the dinosaur and the mastodon are extinct, but the ant carries on. We do not even know whether the eating of proteins considerably above the minimum requirement for growth, tissue repair and nitrogen equilibrium, is biologically indifferent, whether it improves or inspires mental and physical performance, whether it shortens or lengthens the life span. It seems clear at least to me that there is a large territory of unknown factors yet to be scientifically explored before we can talk with any degree of certainty about an optimum diet for man. Therefore those who know the most in this field ought to confine themselves for the present to such terms as a good or an adequate diet, on the positive side. If a good diet or even an optimum diet alone was omnipotent and could push back the hereditary limitations of the individual, we should not so often see differences in physical and mental capacities of children in the same family, at least not in the absence of accidents and non-dietary diseases. If a diet of "red meat" alone was the determining factor on the football field there would be no scores on either side, outside of accidents and luck. Genius, like mortals made of common clay, can neither develop their best nor for long balance on the top rung of the ladder on seriously inadequate diets. It seems equally certain that even optimum diets will not build genius out of all clays. The persistence of hereditary factors and the unknowns of mutation appear to say that much.

Drs. Park and Follis, Jr., of the Johns Hopkins Medical School, have kindly put at my disposal their results to date of their significant and long study on the prevalence of rickets in the bones of 230 children

between the ages of two and thirteen years dying of sundry acute and chronic diseases of non-dietary origin. They find signs of rickets in 46½ per cent. of these children. The acute diseases ending some of these children's lives appear to be of too short duration for the diseases themselves to have been the primary factor in the initiation of rickets although the disease might have aggravated the rickets. It is doubtful that the conditions of rickets in these children could have been diagnosed without this type of examination after death or by biopsis of the bones during life. In my judgment this is a significant approach towards the study of incipient dietary deficiencies and a commentary on society of to-day in failing to apply the known, for we have known for many years the dietary requirements for the prevention of rickets, in the absence of disease.

Our knowledge of the composition of foods, the role of foods in the living body and the specific requirements for the main groups of foods in the living organism—the proteins, fats, starches, inorganic salts and vitamins—has increased enormously in the last fifty years. This detailed knowledge has, however, not gotten down very effectively to the man in the street, the woman in the average home or the people in the factory and on the farm. More recently, the startling character of these biologic and chemical discoveries in human nutrition has, to my way of thinking, led to much unfounded anxiety, fear, wishful thinking and questionable commercial exploitation.

Whether or not we can maintain good health on 40 grams or on 100 grams of protein per day depends largely on the kind of proteins we eat, as the biologic or nutritional value of proteins differs greatly. Some ten so-called essential amino acids are now known. These protein "building stones" are so called because the human body can not make them from the other nitrogenous elements in the diet. However, these essential building stones are present in varying amounts in nearly all proteins of animal and vegetable origin. Man's past history teaches us that if we eat a sufficient variety of natural foods we will get all the essential amino acids needed for good health. Meats, milk, eggs and grains provide good food proteins. The first principle in adequate dietary proteins is accordingly: variety, natural foods, omnivorousness.

Up until yesterday even experts in nutrition thought that the nutritive significance of the animal and vegetable fats in our dietary, besides providing flavor, was: (1) energy or calories and (2) carriers of such dietary essentials as vitamins A, D and possibly others. It now seems highly probable that two or three of the numerous fatty acids in the animal and vegetable fats are as necessary in our diet as are the essential amino acids of the proteins. But, as in the case of the proteins, nutritional welfare of man lies in variety and omnivorousness, since these essential fatty acids occur widely in plant and animal fats.

(B) It is almost superfluous to point out that many diseases, acute and chronic, not primarily of dietary origin, may and do prevent, in part at least, the good effects of good diets. The infant with summer diarrhea no matter what food is given does not get the full benefit of that food. This applies to many diseases of adults. In the presence of hookworm infestation good food alone does not seem to engender maximum physical and mental efficiency. Chronic lead poisoning in the child appears to so interfere with the use of the calcium and the phosphorus in the diet as to induce or aggravate the disease of rickets. We are not now concerned with the important problem, the role of a good diet in the prevention or limitation of infectious disease. Diet alone does not seem to promise the conquest of infections. But when we speak of good or optimum diets for the entire population of the land we must keep in mind the non-dietary disease factors that nullify in whole or in part the good results expected from such diets in individuals having these diseases.

(C) *Food habits.* The food habits of man tend to become as fixed and in many cases as unreasonable as many of his religious, political and social habits. The name of foods, the visual appearance of foods as well as the taste of foods are frequently determining factors. The types of foods consumed by people or races less sophisticated, more ignorant or poorer financially than we are are frequently looked upon by us as degrading, as not good for us. Many people refuse the meat of eels because this fish looks like a snake. Many people think that food good for dogs, cats and hogs are by that token not good for man. A central factor here is obviously social habits as well as the fact that we can train our palate to like or prefer even foods markedly deficient in some of the dietary essentials. For example, the liking for sugar, sweet drinks, candy. Now sugar is a good energy food and such preference for sweets is not serious provided we eat enough of more complete foods. But when foods like pure sugar or pure starch become a larger percentage of our daily diet trouble will follow.

Wherever we turn in the dietary field, past and present, there appears an important factor of safety in omnivorousness. Very few of the natural foods contained chemical or organic poisons for man. Civilized man could be even more omnivorous than he is at present, but we do add serious chemical poisons (lead, arsenic, fluorine) to some of our very important if not necessary food categories, fruits and vegetables. To be sure these insecticides are sprayed on important human foods, not with the intention of in-

juring man but for the purpose of rescuing good human food from insects. However, one of the dietary unknowns to-day is how much of these protoplasmic poisons we can take with our fruits and vegetables during a lifetime without impairing our reserves, impairing our health. The consumer demands a perfect apple. He can see the "worm" or the track of the "worm" in the apple. The lead, arsenic and fluorine on the perfect apple he either can not see or, when he does see them, he thinks it is mere dust from the good earth. We should like to know whether the dietary health of our forbears was worse off with a worm in the apple than is ours with protoplasmic poisons on the apple.

Modifying human food habits in the direction of better health and efficiency may come through necessity or dictation. It will probably not stay put except through understanding via the long and strenuous road of education. In the matter of education in health to the extent that our health depends on food I think there is much yet to be done in our grade schools, high schools and colleges. In a not too distant past the teaching of health in our schools did not significantly transcend the tooth brush, alcoholism, sex and social diseases. Even to-day in many of our schools we find inadequate teaching of the fundamentals of health and nutrition. As if the matter of foods was a concern for women students alone and the matter of general health a concern only of the physicians. We have scarcely begun to realize that the modern sciences of chemistry and physics are so rapidly changing our environment and mode of life that proceeding to-day by the ignorance of our forbears we may travel into tragedy. Urbanization and industrialization renders it well-nigh impossible for modern man to have access to the natural unprocessed foods available to our forebears of a thousand years ago.

(D) *Food advertising.* In connection with this discussion of education of the public in health and foods one necessarily thinks of the positive and valuable role that modern commercial food advertising could play in this program. Unfortunately, such commercial food advertising in the past has frequently been misleading and occasionally undiluted artistic lying. People are urged to eat more of everything. If they did they certainly would develop dangerous obesity. The 1942 advertising of a vitamin alleged to prevent or recolor gray hair on the human scalp is as yet without foundation in science. There are cheerful signs that the more responsible food producers and food processors are now aware of their public responsibility in this field, their responsibility of contributing to factual adult education as to food and nutrition in advertising their special ware. But it is discouraging, to say the least, to have our federal government leaders urge us (in posters, advertisements and circulars): "Eat Nutritional Foods." This is silly, and, if certain foods are listed to the exclusion of others, misleading. For an article which is not nutritional is not a food.

(E) *Food refining and food processing impairing the value of foods.* The polishing of rice, the milling of the germ and much of the protein, vitamins and inorganic salts out of such foods as wheat and other grains, corn, etc., are food practices of the gravest concern to health. Purification and hydrogenation of animal and vegetable fats may take considerable if not all of the fat-soluble vitamins out of these fats. Modern preservation of food such as canning, freezing or dehydration is necessary in modern urbanization. Some food values are diminished, unavoidably, by these processes. Cooking, freezing and packing undoubtedly saves man from infectious disease, but some food values are lost. It is a question of balance of benefits. Fortunately we do still eat raw fruits and some raw vegetables. The latter could and should be greatly extended.

Digestible carbohydrates occur usually in abundance in most of our natural foods. Except by heat to point of carbonization, these food factors are not denatured or destroyed by food processing, baking or cooking, except that the sugars and water-soluble starches may be lost into the cooking and canning liquids. Dextrose, the sugar of the blood, is a necessary constituent for our internal environment. A large part of our heat and energy requirement can and should come from the starches. The starches are our most easily digested and on the whole the least expensive energy foods. So necessary is our blood sugar (dextrose) that, as in prolonged fasting, the body appears to manufacture it from body proteins, and possibly from the body fats. It now seems clear that our body can do the same with the proteins and the fats of our common foods. Hence no specific or distinct dietary deficiency disease of man is known as due to too little starch in the diet. A form of malnutrition, obesity, may be caused by eating too much starch, or sugars, as the carbohydrate in excess of our energy needs is readily converted to and stored as body fat. However, some of the important dietary deficiency diseases have come about, not by eating too much starch, but eating too little of the other important elements in the natural grains. I refer to the polishing of rice and the modern milling of wheat and other cereals for white or patent flour. The germ and the outer coats of the grain hold valuable proteins, vitamins and minerals. Human dietary safety on this front would seem to be: Go back to first principles—putting the whole grain into the flour and the bread. This can be

done. We can learn to like it. If Great Britain (at war) can take an important step in that direction, why can't we?

I believe we could learn to prevent the oxidative rancidity of whole grain flour. If we insist on milling the grain and storing the flour, instead of storing the grain, and milling as needed, there are now known relatively non-toxic antioxidants that might prevent the rancidity of whole grain flour that takes place on long storage. And until we have that problem licked, what is the matter with storing the wheat and milling the flour as we need it? I do not see any essential economic principle in storing the flour in place of storing the wheat. In my judgment, the recent addition of a little of the vitamins and minerals now milled out of the grain, and singing paeans of dietary salvation over this "enriched" flour and bread is not a sound policy either for to-day or to-morrow. Let us go back to first dietary principles on this front. The whole wheat, rye, corn or rice grain is one of our most valuable and our least expensive protective foods. Fortunately, we still eat oatmeal, a whole grain food, having, among other important nutrients, proteins of a high biologic value. On the whole we can trust nature further than the chemist and his synthetic vitamins. Recently Professor J. C. Drummond, the scientific adviser to the British Ministry of Food, voiced his reluctance to put the dietary safety of a nation on synthetic vitamins, as a long-range policy. He thinks we must, and should, provide the natural vitamins in the natural foods. I stand on that platform, until we know a great deal more than we do to-day about foods and human nutrition.

It appears true that for our forbears, except for the element iodine in restricted areas of the earth, the dietary need of minerals was efficiently met by the common non-purified, non-processed natural foods. So far as I know, this would still hold true, except for the cooking of such foods as meats, fruits and vegetables, and the habit of discarding the cooking water. To be sure the otherwise excellent natural food, milk, is so deficient in iron that an exclusive diet of milk for weeks or months brings on an anemia due to the iron deficiency in the diet. How does the American dietary stand as to some of the essential mineral needs such as calcium, phosphorus, iron and iodine? The iodine deficiency in the states whose soil and water were depleted of iodine by the waters from ancient glaciers is now taken care of by putting the iodine back into our table salt. The iodine was there before our ingenious chemists learned to take it out. Professor C. H. Sherman, of Columbia University, has long held the view that the American diet is probably too low in calcium, and possibly in phosphorus, for optimum nutrition. This problem is complicated by the fact that a modicum of vitamin D is involved in the adequate absorption and utilization of calcium and phosphorus, particularly in the growth and maintenance of our bones. I wonder if the possibility of a dietary danger in this field could not be met, universally and without cost, by adding a little calcium, phosphorus and iron to our table salt. This should offer no insurmountable difficulties, and there is no evidence that a slight excess above actual needs of these minerals works any injury to our health.

We are urged to eat milk especially for its calcium. Yes, milk is a good source for lime. But milk is a relatively expensive food, and even in our country, with a plethora of foods, there is not enough milk to go around, at least as long as we insist on butter and cream for our table, and turn so much (50 billion pounds a year) of the valuable skim milk into channels other than human food.

How much of vitamins do we need for optimum health? That the disease scurvy, induced by long subsistence on dried, cured and cooked foods, can be cured or prevented by eating some fresh or raw fruits, vegetables, potatoes, leaves or grasses has been known for more than a hundred years, but the specific chemical substance involved (ascorbic acid or vitamin C) is of very recent acquaintance, and the precise role of this vitamin in our cellular health is still partly unknown. Pellagra, beriberi and rickets are old human ailments, but their precise etiology and partial conquest belong to the last fifty years.

The recent advances in our knowledge of the chemical nature and the biologic role of the vitamins have been so rapid and so startling that, as usual, man's wishful thinking hopes to find in them the cure for nearly all the physical and mental ills to which the flesh is heir. In fact, the miracles now claimed by some misguided people for vitamin pills, natural and synthetic, rival the miracles of Lourdes. The giving a mixture of table salt, vitamin C and vitamin B_1 to workers in very hot environments, observing reduction in fatigue and heat prostrations, and concluding that the vitamins contribute to this desirable result is not a scientific experiment. For we know that under such conditions NaCl alone produces these results, and it is difficult to measure fatigue with accuracy. Vitamin concentrates are useful aids in the hands of a physician. The tragedy and waste in the 1942 vitamin pill business is this: Most of the people who can afford to buy them probably do not need them; most of the people who may need them probably can not afford to buy them. But a competent chemist asserts that "intelligence and morality go together. . . . Since an ample supply of vitamins can foster a high intelligence, it has also the capability of fostering morality!" If this be true, and if we further admit that

lying and injustice are phases of immorality, the vitamin deficiency in the human race of our generation is indeed appalling! When we have the vitamins that prevent dishonesty and injustice, the millennium will have come. But as I read and listen to the 1942 propaganda for vitamin pills, I am led to suspect that at least some vitamin vendors do not take their own medicines. They just sell them. And the selling noise is so loud that our attention is distracted from the more important role of adequate proteins in preventing one of the fundamentals in the overall malnutrition created by such catastrophes as crop failure and war.

(F) *Waste of food.* Waste of food in the family increases the cost of food to the family. It also contributes to food scarcity. Food waste in our country is partly avoidable such as the waste in the home, waste or neglect of fruit and vegetable on the farm; partly perhaps unavoidable such as that produced by oxidative rancidity of fats in the foods. I have already referred to the huge waste of skimmed milk, so far as this is turned into channels other than human food. The waste of food in the home tends to increase with the economic prosperity of the family. It is not "refined" to clean the plate. It is a measure of prosperity and caste to waste food. When we are told that under conditions of war and food rationing in England and Scotland the economically more fortunate eat one third less food than they did in times of peace, this probably means that they eat just as much food in war as in peace, if they can get it, but in war they waste one third less food at the table. When nations are facing universal food shortage, the wastage of food in the home or on the road from the farm to the home may seriously contribute to national malnutrition. Much of this food waste is even to-day preventable, but we are up against individual and social habits and agricultural practices that will yield only to education or dire necessity. Some food wastage in the home as well as in the food-processing industry appears to be based in part on the erroneous assumption that the least roughage in the food we eat the better for our health. So we peel and prune fruits and carrots, cabbage and potatoes and with such peelings and prunings we decrease or eliminate valuable food elements. The facts are the normal human alimentary tract must have some indigestible roughage to work at its optimum, and it will probably take millions of years before man has evolved, like that of the honey-bee, an alimentary tract which can function on nectar and pollen alone. It is difficult to assess the blame for some of the waste of our food, particularly the fats of animal origin. We seem to have developed the idea that the fattest hog and the fattest steer is the best hog and the best steer. These animals may be best in the sense of providing greater income to the farmer, but a great deal of the fat of the steer and even some of the fat of the hog does not reach the human stomach. From the kitchen or the dining table it passes into the garbage can or down the drain pipe.

(To be concluded)

RESEARCH IN WARTIME

By Professor J. H. SIMONS

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AT a time when the nation is engaged in a gigantic war that will determine the very survival of civilization, it is appropriate to examine all our activities in the light of values in the war effort. The only purpose of any real significance for any one's actions is the defeat and destruction of the ememy. All personal or political motives represent various forms of treason. Every activity not contributing to the war effort should be either stopped or redirected. Scientific research should be examined with this point of view.

Modern war requires modern weapons, and these are directly the product of scientific research. It is true that it is a long way from the birth of ideas in the brains of the scientists, their demonstration, verification and study in the research laboratories to the final perfection of powerful weapons for the destruction of the enemy or of materials and tools for the aid and comfort of ourselves and friends. This way, however, follows a direct path that is fully recognized. From the source of the original ideas it progresses through development, engineering, trial and production. All the weapons, tools and materials of vital importance in the war, to a very considerable extent, have had their beginnings in the scientific research laboratories. The research of the past produced our present practices and materials. New things for the future will have their beginnings in the research being done at present. The only sure way of not having new weapons or major improvements of old ones is to stop scientific research.

Research is a word that is used for different meanings by different people. In some industrial firms it is made to include the development of industrial processes after the original ideas are all well founded. In other places it is used to include data collecting or the

operation of well-known and recognized techniques on a small scale in a laboratory. These activities coming under the name research are easily evaluated in relation to the war effort. A process or machine should be developed if it contributes directly to the war effort. Data should be collected if there is a wartime need for it, but otherwise not. In the same way small-scale laboratory operation of known techniques should be continued or not in relation to the use or non-use of the product for the war effort.

The more subtle meaning of the word research—the birth, demonstration, verification and study of new ideas—is a much more difficult thing to evaluate. This type of work is chiefly done in college and university laboratories. To the layman it appears to be only an academic exercise as it is not clearly defined, is not represented at that time by human use on a large scale, and most frequently is clothed in a formidable garment of technical terms. Neither industrial nor government funds are available for it, as the results to be achieved can not be written out in advance. All industrial firms and government agencies require well-formulated objectives for a project as well as a detailed outline of methods of procedure. For fundamental and original research as defined above, these are completely impossible. The real cost of this kind of work comes chiefly out of the hides of those whose artistic or fanatical urge causes them to do it. It comes in the long days (and nights), the Sundays, holidays and vacations spent on the work, frequently without much encouragement or material aids. After the fundamental work is well on its way and the new ideas have been amply demonstrated, government agencies or industrial firms will carry out the development work. The history of science gives numerous examples of the above. The early work in electricity, in organic chemistry and in physical chemistry can be cited, for these, despite their present large-scale industrial use, began in the academic scientific laboratories.

This kind of work has in the past produced results that have changed the entire course of history. Examples of this are the discovery of electromagnetism, the vacuum tube and the synthesis of ammonia and of indigo. On the other hand, the work of any one particular man may not result in such world-startling discoveries, it may only add a small but valuable amount to the sum of human knowledge. It is impossible to predict the value of the fundamental research of any one man. We do know that in general it is this work that is the fountain head of new developments. How soon or how long any particular piece of original and fundamental research will produce results that can be directly or indirectly of military value can not be stated. The undisputed fact is that the more of this kind of work in progress the greater chance there is of new weapons.

The national cost of fundamental research in men and materials is relatively insignificant. There are only a relatively small number of scientists engaged in this work (a few hundred) and their requirements in the way of equipment and help, when considered on a national scale are relatively insignificant. However, at the present time it is not sufficient to take a point of view that we can "let" them work. Letting at this time must be a positive and not a negative action. It must mean that such scientists and their students be not required for other duties such as military service or civilian defense. Their income must continue. They must have help and funds for securing materials. They must be provided with assistance and technical aids. In other words, funds, priorities and draft deferments have to be considered as part of the word "let." The assignment of priorities for research materials shows that this is recognized by the government. It is of course also important that the institutions in which this work is in progress should not consider it as an unessential academic exercise or an extra burden on the overhead account.

At the time, several years ago, when our government first recognized that our entry into the war was unavoidable, it was natural to take the point of view (and this was done by some of our military people) that the research that would be used or needed in this war was all done and that the war would be fought with what we had. They thought the same about steel capacity and the designs of tanks and planes. As the military leaders can not predict the length of the war, the time available for research to aid in it is also unpredictable. If the war is short, there is no need of disturbing or changing the present fundamental research program. If it be long, then there is a vital need for both continuing it and augmenting it in the near future. No one can tell from what laboratory will come new and important discoveries. We are certain, however, that the more fundamental and original research done the greater the chance of the discoveries. The one way not to have the discoveries would be to close the laboratories. We may be in vital need of new discoveries. Without them we shall be placed in the position of giving the enemy the initiative and following his discoveries with a time disadvantage.

Scientific advancements made during the war may be very important. The development of the synthesis of ammonia in Germany in World War One caused the blockade to be much less effective than the military

leaders of the Allies figured, because Germany was then not dependent upon Chile saltpeter for its explosives. It is the new discoveries made now or in the near future that may shape the course of victory.

To be unduly critical of any one particular fundamental research project as impractical or of only "theoretical" interest and therefore not significant for the war effort at this time is highly unsound reasoning. How can any one tell in advance to what extent or how soon it can be put into practice. What is highly theoretical to-day is put into large-scale practice to-morrow.

One can not determine the value of research to the war effort by whether or not it is fostered or financed by a government agency. Government agencies support and develop discoveries once they are made, and they also direct this development toward ends of military value. New ideas and discoveries, however, are most likely to spring up in laboratories devoted to original research, and it is these new discoveries that can then be taken by the government agencies for development. In fact, those discoveries made in the recent past in chemistry that are having the most significance at present in the war effort were not made in government sponsored laboratories. Some of these in their beginning stages would not have been financially aided by any government agency or industrial firm, as they differed greatly from commonly accepted practice. In its inability to know just which laboratory, working on original work, will produce the most vital results for the war, science is not much different from the military. The high command can not tell in advance just where the most important battles will take place. Many garrisons and bases will be unused. Many divisions and material will not see action. We can not in advance, however, say that these divisions are unnecessary.

Fundamental and original scientific research is, therefore, not only of great value for the war effort, but its continuance may be vital for victory. It is not an activity of secondary value for such things as morale or the selling of bonds, regardless of the values of these activities. Its products may have a direct bearing on killing the enemy and certainly will have, if the war lasts for years. How to continue it under present difficulties and restrictions is a matter for serious consideration. In this connection the following suggestions are made:

(1) Scientists of recognized tendencies toward original work and of proven accomplishments in fundamental research should be encouraged to continue. They should not be taken for what may be more emotionally satisfactory, work on a development project under a government contract.

(2) Priorities and draft deferments should be provided.

(3) Funds will be needed; but these should be free from the requirements of extensive reports and outlines of procedures in advance, such as are now required in most government and industrial work.

(4) The work should not be "directed" by some "committee chairman." Committee chairmen can not be familiar with the work—otherwise they would be doing it.

(5) The funds should not be dependent upon the individual scientist's political connections or his ability to get elected or appointed to committees or society offices.

(6) Students should be permitted and encouraged to enter fundamental scientific work. A great deal of this kind of work has been done in the past by students under the direction of a professor interested in fundamental research. At the present time there is danger of encouraging students to enter the so-called more "practical" lines of work. General Hershey in his statement regarding the deferment of graduate students considers only those assisting in instruction and those working on a sponsored "war project" as eligible for deferment. Research on fundamental and original scientific problems should be placed in the same category as the work sponsored by government agencies as its chance of direct value in the war is at least as great.

(7) In order to insure that the scientist engaged on original and fundamental research can direct his thoughts along lines such that his creative ideas will have the best chance of being of immediate military value, he should be made familiar with the problems, materials and techniques of military importance that are related to his branch of science. This can be done without confining him to work on any particular project and without danger of loss of confidential and secret subject-matter. The scientists of this country realize full well that our defeat will mean that they, each and every one, will be executed shortly thereafter. They have the knowledge of what has happened to their colleagues in the occupied countries of Europe. They are very anxious to help so that this will not happen here.

The day that fundamental and original scientific research stopped in Germany was the day that Germany began losing the war. This will be true provided that we do not stop our fundamental scientific research. We are in great danger of doing this at this time with our scientists being taken for development projects and other activities. If the war is a long one, we will greatly regret the loss of the scientist and his students doing original work.

OBITUARY

EDMUND SMITH CONKLIN
1884–1942[1]

ALL of us who were intimately associated with Dr. Edmund S. Conklin in his last years of life were deeply impressed with the calm manner in which he carried on while facing the constant threat of impending death. To the admonitions of doctors and colleagues that he give up all work and rest, he answered that when the fatal stroke came he wanted to be at his usual occupation. And so it was, that, although in his last months he was not able to do much, the end came the morning after he had spoken to a religious gathering on some psychological aspects of religion. Up to the last he was hoping to be present at the New York meeting of the Psychological Section of the American Association for the Advancement of Science. To him it seemed an opportunity lost when he could not be present to meet and chat with his many professional and personal friends.

It was characteristic of Dr. Conklin eagerly to seek and cultivate social relations. He was never as happy as when he could converse intimately with his friends concerning human problems. Indeed, it was probably this trait that directed him into psychology. Quite clear he made it to his friends that psychology was to him primarily a concern with persons and everyday activities of people. This is further manifest in his lectures and writings. In recent years he deplored certain psychological trends toward abstractness and severe formulation. He contrasted this tendency with the situation in which he grew up at Clark University when G. Stanley Hall was the dominant figure there.

A graduate of Springfield College and Clark University, he helped to give Oregon a reputation for being in some ways more like New England than New England itself. His lively interest in students is shown by his request that the student members of his fraternity, Phi Gamma Delta, call him "Ned," and the fact that his lectures in general psychology were considered outstanding by students. At the same time that he attracted such informal interest of undergraduates he always remained Dr. Conklin to his colleagues and graduate students, not through any lack of friendliness, but simply as a mark of professional respect to a scholarly gentleman.

Having gathered together a staff with whom he built the splendid Oregon psychological laboratory, together they attracted a small and highly selected group of major students whose subsequent professional development was always a matter of great pleasure of the Oregon group, particularly in their gatherings at annual meetings.

His viewpoint on the administrative functions of a department chairman may be illustrated by an early incident. When one of the writers came to Oregon from an N. R. C. post-doctorate fellowship, he called him into his office, told him what regular funds were available for his work, mentioned that he had also built up a special fund to enable the new laboratory man to provide equipment in line with his special interests, and then after showing him around the fine new laboratory gave him his only "sailing orders" in six years, by telling him to develop the laboratory courses as he saw fit, and to come to him if he could be of assistance. For him, administration was a matter of selecting personnel, and then giving them full opportunity to develop their plans, and unusually liberal and successful policy.

In 1934, when he was in middle life, Dr. Conklin was called to assume the chairmanship of the department of psychology in Indiana University. His eight years of service there were years of tranquility and orderly development for the department. His ideal was to provide the greatest possible academic liberty and freedom from annoyance for his colleagues and to encourage them in scientific productivity. As an administrator, Dr. Conklin was especially earnest in conceiving himself as "chairman" rather than "head" of a department. Matters of policy were placed before a staff conference; the decision was theirs, and a favorite project would be abandoned rather than pursued against the wishes of others. It was through their own merit that his careful plans were adopted and guided the department. The impress of his work at Indiana will be felt and remembered for years to come.

To the general public Dr. Conklin will probably be best known for his books in the fields of abnormal, genetic and religious psychology, all based on very extensive library research. Doubtless, he, himself, would have considered his greatest accomplishment to be whatever professional and personal assistance and direction he was able to give his colleagues and students in their careers as psychologists. To his earlier associates and students, now scattered among many of the larger departments of the country, psychology as Dr. Conklin conceived it to be remains a high standard by which to measure one's own professional development.

[1] This memorial statement was prepared by three of Dr. Conklin's former colleagues at the request of the executive committee of the Section of Psychology of the American Association for the Advancement of Science. Dr. Conklin was the retiring vice-president of the association and chairman of the Section of Psychology, and it was planned to read the memorial statement in place of his vice-presidential address at a joint session of the Sections of Psychology and Education at the New York meeting. Owing to war conditions, this meeting was not held.

In addition to his teaching and administrative duties, Dr. Conklin generously devoted considerable time to public lecturing. He was especially fond of presenting to psychological audiences the life and manners of his teacher Hall. In other than psychological groups he probably was most devoted to the discussion of religious topics, especially the comparison of the various forms of worship.

The essentially human interests of Dr. Conklin were revealed in his general literary reading. Samuel Johnson, the man, appealed to him inordinately. Upon occasion Dr. Conklin could spend an entire evening recounting various interesting items concerning Johnson, and evaluating the literature centering around this interesting figure. In him he found a subject which afforded scope for the expression of his own great fund of humor.

ROBERT H. SEASHORE
R. C. DAVIS
J. R. KANTOR

RECENT DEATHS

DR. WILLIAM HENRY METZLER, formerly professor of mathematics and dean of the Graduate School of Syracuse University, later dean of the State Teachers College at Albany, N. Y., died on April 19. He was seventy-nine years old.

DR. RICHARD A. VON MUTTKOWSKI, since 1925 head of the department of biology of the University of Detroit, died on April 15 at the age of fifty-six years.

THE death at the age of sixty-seven years is announced of Dr. Frederick Barry, professor of the history of science at Columbia University.

CHARLES C. WILLOUGHBY, since 1928 director-emeritus of the Peabody Museum of Harvard University, died on April 21 at the age of eighty-five years.

DR. JOHN EDWARD WILLIAMS, professor of mathematics and dean of the faculty of the Virginia Polytechnic Institute, died on April 19. He was seventy-five years old.

LIEUTENANT COLONEL WALTER W. PLECHNER, assistant director of research of the Titanium Division of the National Lead Co., was killed in action in North Africa on March 4.

WILLIAM R. WEBB, assistant deputy chairman and director of Eastman Kodak, Ltd., England, died on April 16. He was fifty-four years old.

DEAN WILLIAM H. G. LOGAN, of the Dental School of Loyola University (Chicago College of Dental Surgery) since 1920, died of a heart attack on April 6 at the age of seventy years. Dr. Paul C. Kitchin, secretary of the dental subsection of the American Association for the Advancement of Science, writes: "Dr. Logan was an oral surgeon and educator of international reputation and the holder of honorary degrees from the University of Michigan, Loyola University and the National University of Ireland. During World War I Dr. Logan played a prominent part in the establishment of the Army Dental Corps. From 1917 to 1919 he was chief of the Dental Division of the Surgeon General's Office and held the rank of colonel. He was a past president of the American Dental Association (1917–1918) and of the American Association of Dental Schools (1928) and a fellow of the American College of Surgeons."

Nature reports the death of Sir Sidney Burrard, Bart., F.R.S., formerly Surveyor-General of India and superintendent of the Trigonometrical Survey of India, on March 16, aged eighty-two years; of H. G. Denham, dean and professor of chemistry, Canterbury University College, Christchurch, New Zealand, and chairman of the New Zealand Council of Scientific and Industrial Research, aged sixty-two years; of J. Eustice, emeritus professor of engineering at University College, Southampton, on February 24, aged seventy-eight years, and of Dr. F. G. Parsons, research fellow in anthropology at St. Thomas's Hospital, formerly professor of anatomy, University of London, on March 11.

SCIENTIFIC EVENTS

SWEDISH FOREST PRODUCTS

ACCORDING to the Swedish International Press Bureau, as reported in *Nature*, a survey of Sweden's production of forest products of a chemical nature was recently made by Otto Cyren, director of the Swedish Chemical Office. Speaking of chemical pulp, one of Sweden's most outstanding export products in normal times, he said that Sweden is in a very good position in respect of quality, as the slowly growing timber in northerly regions gives very long fibers, and consequently the strongest pulp and paper are obtained from it. The most important by-product of the sulphite pulp production is sulphite spirit, which up to most recent years was the only product recovered. Mixed with petrol, it was of importance as a motor fuel. The purity of the rectified spirit now surpasses that obtained from grain and potatoes, and it is therefore used also for human consumption. Researches on the possibility of using sulphite spirit as the basis of more highly developed products were not initiated until the present crisis made the matter urgent. As an instance he described the work carried on by the

Mo and Domsjo Company. In 1941 this company completed a factory for the production of sulphite spirit with a capacity for 10 million litres of 95 per cent. spirit a year. At this factory intensive research work is going on, with the view of producing various synthetic products from the spirit. From the black lye obtained in the sulphite pulp process there are produced *inter alia* certain crude acids, the first factory for using this raw product having been built at the Bergvik och Ala pulp mill. The sebacic acid produced here, called "pine fatty acid," is used to replace fat in washing mediums, as a substitute for linseed oil in paints, etc.

The output of charcoal in Sweden has trebled in the last couple of years, mainly due to the extensive producer-gas traction of motor-cars, and the by-products from the carbonization are now being recovered more carefully than before. The charring of old tree stumps, with their high content of rosin, alone gives about 20,000 tons of tar a year. Wood tar is now used as motor fuel for fishing boats in place of crude oil, and has probably saved the Swedish high-sea fisheries from total stoppage. It is also used for the production of lubricants. In summing up the situation for the Swedish forest products industry, Mr. Cyren stated that in 1941 the Swedish exports of woodstuffs had declined by about one third, and the pulp and paper by two thirds, compared with the pre-war level. But in compensation the forests, by supplying cattle feed, wood fuel, motor fuel, lubricants, textile material, fatty oils and a good many other useful products, have saved the country from catastrophe.

INDUSTRIAL RESEARCH LABORATORY OF THE UNIVERSITY OF ROCHESTER

AN industrial x-ray laboratory equipped with a million-volt unit, one of the most powerful in the world, has been established at the University of Rochester. The laboratory is the joint enterprise of the university and eight industries. It was formally opened on April 19 with an inspection visit by industrial leaders, educators, scientific men and Army and Navy ordnance department representatives.

Dr. E. E. Charlton, of the General Electric Research Laboratories, who designed the apparatus, said in an address at a dinner in connection with the "open house" that the project represents "a novel and most useful cooperation in the joining of hands of university and industry in the developing of the full use of x-ray in the industrial field."

With the development of million-volt x-ray machines, minute inspection of heavy steel parts is possible in a matter of seconds and minutes, as compared with the hours or days required under the quarter-million volt apparatus used until recently. He continued: "Industry is waking to the potential value of this powerful new development, but this installation in Rochester will most usefully facilitate the exploring of its applicability to many diverse products at the same time that new problems are presented in devising the most efficient means for using this new tool. For instance, it seems most unlikely that the photographic film and the intensifying screen developed for use in industrial x-ray laboratories to-day are the optimum for million-volt radiography."

John H. Clough, president of the General Electric X-Ray Corporation of Chicago and an alumnus of the university, welcomed the enterprise as "recognizing a type and degree of cooperation between industry and an educational institution that I believe is unique in its conception. Certainly the university is to be congratulated upon its recognition and enthusiastic acceptance of a war-time responsibility to assist American industry in the production of materials that will spell victory for the cause of liberty, and the industries of the Rochester area that have participated in the establishment of the new laboratory are to be complimented upon their generous cooperation with an institution that can be the source of much assistance during this period of tremendous pressure on the country's manufacturing abilities and facilities."

He added, "the powerful x-ray apparatus thus made possible studies that provided a guide to manufacturing procedures that are faster and better than anything we have heretofore enjoyed." Beyond the practical value of the new laboratory, in his opinion, is the significant relationship between education and industry "that can lead to advances beneficial not only to themselves, but to all mankind."

The immediate use of the unit at the University of Rochester is to speed production of war materials in local industries by rapid tests of castings, making it possible to detect flaws in pilot castings to determine if the casting technique is correct before starting mass production.

The undertaking was financed by eight Rochester industries, among them Eastman Kodak Company, Rochester Products and Delco Appliance divisions of General Motors; the Pfaudler Company, the Rochester Gas and Electric Corporation, Consolidated Machine Tool Corporation, Symington-Gould Company and the Rochester Brewing Company.

The university supplies the scientific staff to make the tests and is free to use the equipment for research in metallurgy, medicine and engineering. Part of a second million-volt unit is installed in another part of the laboratory for medical research on cancer. The remainder will not be available until after the war.

Dr. Alan Valentine, president of the university, expressed its deep appreciation of the vision and generosity of the industrial heads who made the proj-

ect possible. Not only will the laboratory quicken the war effort, he said, but the collaboration it represents "holds great possibilities for after the war, in the availability of the equipment for research both from a medical and engineering standpoint."

In discussing the prospects for even more powerful x-ray machines, Dr. Charlton said: "We whose task it has been to raise the voltage limitations in x-ray sources are vastly impressed by the advantages which are taking place, and are eager to climb to further heights. We see no fixed barrier to the extension of our present design to considerably higher voltages and already have planned and hope soon to start the construction of a generator which will bring the next upward step. Just as million-volt x-rays have proved so much more advantageous than those of the quarter-million volt formerly used, so it may reasonably be hoped for still further advantages "as we progress into the multi-million volt field. How far that progress may continue before we reach the point of diminishing returns we do not yet know. That is one reason for our growing interest in the 100 million volt electronic accelerator which we have near completion in Schenectady, and our research will give us the answer."

RARE CHEMICALS

THE following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1. iso-thymol (U.S.P.)
2. l-mono-iodotyrosene
3. 1-3,5 di-iodothyronene
4. di-lauroyl peroxide
5. Succinyl peroxide
6. di-butyryl peroxide
7. acetyl benzoyl peroxide
8. pyrophosphate peroxide
9. phenylactic acid
10. phenylpyruvic acid
11. p-hydroxyphenyl pyruvic acid
12. ethylene disulphonate
13. zinc dimethyldithiocarbamate
14. hexammine cobaltic chloride (U.S.P.)
15. sodium penta cyanoammine ferroate pure
16. cobalt thiocyanate
17. p-cyano benzaldehyde
18. indican (relatively pure)

AWARD OF THE NICHOLAS APPERT MEDAL TO DR. PRESCOTT

THE Nicholas Appert Medal was awarded to Dr. Samuel Cate Prescott, emeritus dean of science of the Massachusetts Institute of Technology, at a meeting of the Chicago Section of the Institute of Food Technologists.

The presentation will be made by M. E. Parker, chairman of the Section, at the annual banquet session at the Statler Hotel, St. Louis, Mo., on June 3.

This award was established in 1941 by the Chicago Section, then under the chairmanship of Dr. E. H. Harvey, now chairman of the St. Louis Section. The medalist is elected by a jury of nine leading technologists representing various divisions of the food processing industry from as many different geographical areas. Eligibility for the award is based on preeminence in the field of food technology and on contributions to the progressive development of food manufacture and processing.

During World War I food dehydration for overseas shipment became Dr. Prescott's chief activity as a division chief in the U. S. Department of Agriculture and later as an Army officer. Upon return to peace-time activities, his previous work with the application of low temperatures for food preservation gave him entrance into the field of quick freezing. During the formative years of that industry his counsel and guidance were much in demand.

Since his retirement last June as dean of science of the Massachusetts Institute of Technology, he has again been called into consulting service by the Dehydration Committee of the U. S. Department of Agriculture and by the Research Laboratories of the National Canners Association. At the present time he is active in that work.

As dean of science at the Massachusetts Institute of Technology, Dr. Prescott initiated the International Food Technology Conference at Cambridge, Mass., in September, 1937, and again in June, 1939, which resulted in the founding of the Institute of Food Technologists.

CONFERENCE ON PHYSICS

As the guests of the President of Mexico, General Manuel Avila Camacho, and the Governor of Puebla, Mexico, Dr. Gonzalo Bautista, a group of prominent men of science from the United States will go to Mexico to attend the First National Conference on Physics to be held in Puebla the first week in May.

The call for the conference was issued in October, 1942, by Governor Bautista, the director of the National Astrophysical Observatory at Tonanzintla, Puebla, Señor Luis Enrique Erro and the president of the University of Puebla, Dr. Raimundo Ruiz. It stated that "a people that pretends to secure all the advantages of civilized life can not overlook the progress of physics nor can it substitute the tremendous resources of this science with activity in other fields, no matter how important these may be."

The agenda for the conference embraces four broad points:

Primary Particles of Physical Reality;
Physics in Education;
Physics in Production;
Physics and the Problems of War and Peace.

The Mexican Ambassador to Washington, Dr. Francisco Castillo Nájera, and Governor Bautista of Puebla made an official visit, early this month, to the State of Massachusetts, at which time they delivered the autographed invitations of the President and of the Governor to guests from the United States, through Dr. Harlow Shapley, director of the Harvard College Observatory, whose cooperation with the Mexican Government for a close collaboration between men of science of both countries, was highly praised by both the Ambassador and the Governor in their addresses at the special meeting of the American Academy of Arts and Sciences in Boston, organized in their honor.

In his autographed invitation, President Avila Camacho of Mexico stated that his Government organized the Conference on Physics "inspired by its desire to contribute to the maintenance and advancement of science and culture in the American Continent, as a means to limit the collapse both have suffered in the countries devastated by the present conflagration."

Professor Albert Einstein was one of the invited guests, but his health will prevent his attendance, although he hopes to send a paper to be read at the conference. Among the guests are Dr. S. Chandrasekhar and his wife, from British India, at present residing in this country.

Señor Salvador Duhart, first secretary of the Mexican Embassy in Washington, will proceed to Mexico accompanying the guests of the President and the Governor, all of whom will gather in San Antonio, Texas, the last day of this month, to continue by rail to Mexico City and Puebla.

The new Benioff-vertical seismograph, recently acquired by the State Government of Puebla for the National Astrophysical Observatory at Tonanzintla, will be inaugurated after it has been installed and put into operation by Dr. L. Don Leet, director of the Harvard Seismological Station, who is one of the invited guests.

PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PLANS for the twenty-seventh annual meeting of the Pacific Division of the American Association for the Advancement of Science are almost complete. The dates have been fixed for the period June 14–19, the host institution to be the Oregon State College, Corvallis.

To supplement the preliminary announcement in the issue of SCIENCE for March 5, it might now be stated that there will be three addresses of public interest during the course of the meeting: one by Professor Linus Pauling, president of the division, on the "Relation of Molecular Structure to Biology and Medicine"; the second by Professor Eliot Mears, Stanford University, on "Post-war Problems of the Pacific Area," and the third by Professor Agnes Fay Morgan, University of California at Berkeley, on "Nutrition in Wartime." These addresses will be presented on the evenings of June 15, 16 and 17.

Tuesday, June 15, will be devoted to general sessions. In the morning there will be a divisional symposium on a "Century of Science in the Pacific Northwest," with a group of addresses covering the fields of agriculture, engineering and forestry. In the afternoon several papers in the field of reviews of current research will be presented: *Genetics,* George W. Beadle, Stanford University; *Botany,* A. S. Foster, University of California at Berkeley; *Zoology,* A. R. Moore, University of Oregon, and *Mathematics,* R. M. Winger, University of Washington.

SCIENTIFIC NOTES AND NEWS

DR. VINCENT DU VIGNEAUD, professor of biochemistry at the Cornell University Medical College, has been given the $1,000 award of the Mead Johnson and Company for research on the B-complex vitamins, in recognition of his work on the structure of biotin.

DR. SYLVANUS G. MORLEY, archeologist of the Carnegie Institution of Washington, has been awarded the Loubat Prize of $1,000 of Columbia University.

DR. GEORGE D. BIRKHOFF, Perkins professor of mathematics at Harvard University, has been elected an honorary member of the Royal Irish Academy in the department of science.

DR. H. S. JENNINGS, professor emeritus of the Johns Hopkins University, was presented, on April 8, with a portfolio of letters of greeting from his former students and friends in honor of his seventy-fifth birthday. Dr. Jennings is now at the University of California at Los Angeles.

SIR ALDO CASTELLANI, formerly professor of tropical medicine and head of the department of medicine of the School of Medicine of the Louisiana State University, now Lieutenant Colonel in the Italian Army, has been decorated by the Italian Government for his "abnegation and devotion during the operations in North Africa."

IT is reported in *Nature* that the trustees of the Ray Lankester Fund have appointed Dr. Shu-Ping Chu, of Queen Mary College, University of London, as

investigator for 1943–44 to carry out research at the Plymouth Laboratory of the Marine Biological Association on the effect on the development of marine algae of the presence or absence of different substances in sea water.

THE Council of the American Institute of Nutrition met in Detroit on March 31 in the annual business session. The officers for the coming year are H. B. Lewis, *President;* Icie Macy Hoobler, *Vice-president;* Arthur H. Smith, *Secretary;* W. H. Sebrell, Jr., *Treasurer;* Lydia J. Roberts, Genevieve Stearns and T. H. Jukes, *Councillors.*

DR. CLYDE LEAVITT, assistant dean of the New York State College of Forestry, Syracuse University, who now has leave of absence, will retire on November 1.

DR. GRAHAM PHILLIPS DUSHANE, of the University of Chicago, has been made acting professor of biology at Stanford University to serve during the spring and summer quarters.

IT is reported in *Popular Astronomy* that Dr. Carlos U. Cesco and Dr. Jorge Sahade, of the Astronomical Observatory at La Plata, Argentina, have been appointed volunteer research assistants at the McDonald and Yerkes Observatories and will arrive in the United States in the latter part of the summer. They are being sent by their government to investigate methods in astronomy and astrophysics now in use at the Yerkes and McDonald Observatories. Guido Münch Panagua, of the National Observatory of Mexico at Tacubaya, has been appointed assistant at the Yerkes and McDonald Observatories for one year. He will replace one of the assistants who has left to join the armed forces.

DR. FREDERICK P. KEPPEL, who retired recently as president of the Carnegie Corporation, has been elected a director of the Columbia Broadcasting System.

MAURICE L. MOORE, formerly research chemist in the Medical-Research Division of Sharp and Dohme, Inc., has joined the Scientific Laboratories of Frederick Stearns and Company, Detroit, as director of organic research.

DR. S. C. OGBURN, JR., acting research manager and technical supervisor, in charge of new product development of the General Chemical Company, has been made manager of the Research and Development Department of the Pennsylvania Salt Manufacturing Company. During the past year, he served as Washington representative of the Technical Department of the General Chemical Company. Earlier he was professor and head of the department of chemical engineering and chairman of the division of engineering of Bucknell University.

DR. C. MARTIN WILBUR, curator of Chinese archeology and ethnology at Field Museum, Chicago, has leave of absence to join the staff of the Office of Strategic Services at Washington, D. C., for the duration of the war.

BRIGADIER GENERAL JAMES STEVENS SIMMONS, A.U.S., director of the Preventive Medicine Division of the Office of the Surgeon General, U. S. Army, delivered the John Wyckoff lectures at New York University on April 15 and 16. The titles of the lectures were "The Preventive Medicine Program of the United States Army" and "The Present State of the Army's Health."

DR. HARLAN TRUE STETSON, of the Massachusetts Institute of Technology, gave the address at the University of Maine on April 15 in a celebration program commemorating the quadricentennial of the death of Copernicus. The occasion was under the auspices of Sigma Xi, and the subject of the lecture was "The Earth and Sun: from Copernicus until To-morrow."

DR. OTTO LOEWI, research professor of New York University, gave a series of lectures and conferences recently at the Ohio State University under the auspices of the Graduate School and the Society of Sigma Xi.

DR. LAURENCE H. SNYDER, of the Ohio State University, addressed on March 31 the colloquium of the Yerkes Laboratories for Primate Biology at Orange Park, Fla. He spoke on "Heredity in Apes and Man."

IN an article by Dr. Henry, entitled "Doctorates in Science," in the issue of SCIENCE for April 9, Dropsie College is referred to as primarily theological. The Dropsie College is a postgraduate, scientific institute in Hebrew and Semitic civilization, non-sectarian and non-theological in nature.

DR. FRANK E. E. GERMANN, executive secretary of the Southwestern Division of the American Association for the Advancement of Science, has announced its decision that owing to war conditions it is inadvisable to hold the annual meeting at Colorado Springs. It is planned to extend the terms of the present officers until such time as the next meeting can be held.

THE Midwestern Psychological Association, by a vote of 123 to 6, has decided to suspend all meetings, elections of officers and new members and collection of dues, until the wartime restrictions on travel are removed. The normal activities of the association will be resumed at the end of the war when the officers will call a meeting. The newly elected president is Professor S. L. Pressey, of the Ohio State University;

the newly elected member of the council is Professor M. A. Tinker, of the University of Minnesota.

UNDER the auspices of the Pittsburgh Committee for the Copernican Quadricentennial, the Polish Institute of Arts and Sciences, now playing the role of the Academy of Science in Exile, will hold three conferences on pure and applied science at Mellon Institute during the week of the celebration, which will be held from May 11 to 13. *A Conference on Pure Science* will be held on May 11 at 4:30 P.M., when the speakers will be Dr. Mrzowski, of the University of Chicago, and Dr. O. E. Jennings, head of the department of biology, University of Pittsburgh, curator of botany and director of education, Carnegie Museum; *A Conference on Applied Science* on May 11 at 8:15 P.M., at which T. Sendzimir, metallurgical engineer, and Dr. H. H. Lowry, director, Coal Research, of the Carnegie Institute of Technology, will speak; *A Conference on Nutrition* on May 12 at 2:30 P.M., at which the speakers will be Dr. Maria Gutowska, Massachusetts State College, and Dr. Herbert H. Longenecker, professor of biochemistry, director of the Buhl Foundation Research Projects, University of Pittsburgh.

THE research conferences to be held this summer at Gibson Island under the auspices of the American Association for the Advancement of Science include a symposium on "Hormones," to be held from July 19 to July 23, with F. C. Koch, Armour and Company, Chicago, chairman, and H. Jensen, the Upjohn Company, Kalamazoo, vice-chairman. The speakers will include A. White, Yale Medical School; B. Chow, the Squibb Institute for Medical Research; George W. Irving, U. S. Department of Agriculture, Southern Regional Research Laboratory, New Orleans; C. N. H. Long, Yale Medical School; M. H. Kuizenga, Dwight J. Ingle and H. Jensen, the Upjohn Company; F. D. W. Lukens, University of Pennsylvania; W. T. Salter, Yale Medical School; Thomas R. Wood, University of Pittsburgh; T. F. Gallagher, University of Chicago; E. Schwenk, Schering Corporation, Bloomfield, N. J.; S. Gurin, University of Pennsylvania; H. L. Fevold, U. S. Department of Agriculture, Western Regional Research Laboratory, Albany, Calif.; Louis Levin, College of Physicians and Surgeons, Columbia University; K. W. Thompson, Yale Medical School, and F. C. Koch. Requests for additional information should be addressed to the director of the conferences, Dr. Neil E. Gordon, Wayne University, Detroit, Mich.

THE British Association held a conference at the Royal Institution on March 20 and 21 to discuss "Science and the Citizen: the Public Understanding of Science." Sir Richard Gregory, the president, opened the conference, and in addition to members of the association scientific men from the British oversea Empire, representatives of the allied nations and others interested in scientific movements attended. The subjects at the four sessions were, respectively, the exposition of science, radio and cinema, science as a humanity, and science and the press. Sir Henry Dale, president of the Royal Society and director of the Royal Institution, presided at the first session; the chief speakers were Sir Lawrence Bragg, Professor Allan Ferguson and Professor J. A. Lauwerys. A message was read from Sir John Anderson, Lord President of the Council.

IT is stated in the daily press that ninety-six institutions and agencies throughout the United States will receive gifts amounting to $1,945,000 under a deed of trust from the estate of Louis D. Beaumont, valued at $13,000,000. He was one of the founders of the May Department Stores Company, a national chain, who died in New York last October 1. The residual estate will be divided among charitable, literary, scientific, educational and religious organizations to be selected. Among the cash bequests are $200,000 to Western Reserve University, and $100,000 each to St. Louis University and Washington University, St. Louis, and the University of Denver.

THE *Journal* of the American Medical Association states that the William Buchanan Foundation of Texarkana has given to the University of Texas $200,000 for a five-year program on child health. The details were concluded at a meeting in Galveston, Texas, between Dr. Stanley J. Seeger, Texarkana, president of the foundation, and Dr. Chauncey D. Leake, dean of the medical branch. The program will be worked out in conjunction with the department of pediatrics of the medical branch, correlating the activities of the department of other state and national agencies. Its purpose is to afford the profession in Texas an opportunity to maintain the latest methods in connection with the promotion of child health, especial attention to be given to the problems of the adolescent in wartime.

ONE TENTH of the residue of the estate of the late Sir Edward Beatty, a former president of the Canadian Pacific Railway, has been bequeathed to McGill University. The university will also receive Sir Edward's library.

THE National Research Council announces the award for the academic year 1943–44 of fourteen fellowships of the value of $750 each, thirty studentships of $650 each and twenty-one bursaries of $250 each. The group of sixty-five successful candidates for these postgraduate scholarships comprises graduates of fifteen Canadian universities who will conduct

research work in the coming year at eleven of these institutions. As a result of war conditions, the fields of science in which the scholarship holders will work are reduced in number as compared with a few years ago. By far the greatest number will work in various branches of chemistry related to the war effort. Smaller numbers will work in physics, engineering and other subjects largely connected with war research.

DISCUSSION

DESTRUCTION OF RED BLOOD CELLS AFTER FAT INGESTION

JOHNSON and Freeman[1] have shown that the thoracic duct lymph of dogs fed fat is markedly hemolytic. Fatty acids and soaps, which have presumably escaped resynthesis into neutral fat during absorption, are present in duct lymph in quantities sufficient to account for the hemolysis observed.[2]

Although this lymph empties but slowly into the blood stream, after a fat meal the circulating red blood cells become exposed to a sufficient quantity of the hemolytic agent to cause an acceleration of the normal daily red blood cell destruction, so that in dogs[3] and in man[4] the daily excretion of the degradation products of hemoglobin is greater on a high fat diet than on a low fat diet.

More directly, Longini, Freeman and Johnson[5] have demonstrated in dog's lipemic blood the presence of an agent which increases the fragility of red blood cells.

It has now been possible to show that drinking one pint of 32 per cent. cream (150 cc of fat) causes human serum to become injurious to red blood cells, increasing their fragility. Details of this experiment will be published elsewhere.

Although the extra blood destruction resulting from fat ingestion seems to be insufficient to produce anemia in normal individuals, whose bone marrow is capable of replacing these extra cell losses, it remains to be determined: (1) whether regeneration of red cells after blood loss, when the bone marrow is excessively taxed, might be hastened by a low fat diet, and retarded by a high fat diet, or (2) whether abnormalities in fat absorption or abnormal sensitivity of cells to the hemolytic agent described might contribute to the production of certain human anemias not associated with blood loss.

These possibilities are under investigation in this laboratory.

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[1] Victor Johnson and L. W. Freeman, *Am. Jour. Physiol.*, 124: 466, 1938.
[2] L. W. Freeman and Victor Johnson, *Am. Jour. Physiol.*, 130: 723, 1940.
[3] L. W. Freeman, A. Loewy, A. Marchello and Victor Johnson, *Fed. Proc.*, 1: 25, 1942.
[4] H. W. Josephs, L. E. Holt, H. C. Tidwell and C. Kajdi, *Jour. Clin. Invest.*, 17: 532, 1938.
[5] Joan Longini, L. W. Freeman and Victor Johnson, *Fed. Proc.*, 1: 51, 1942.

GONADAL HORMONES IN SNAKES

ANDROGENIC and estrogenic content of the gonads of several vertebrates has been tested since the work of Allen and Doisy,[1] Martins and Rocha e Silva,[2] Moore, Gallagher and Koch.[3] Also the gonads of ovoviviparous snakes contain these substances. We have assayed an alcoholic extract from the testes and ovaries of 324 *Bothrops jararaca* and *Crotalus terrificus terrificus*. The residue of alcoholic distillation was extracted by ether, this evaporated and the oil matter so obtained mixed with arachnis oil.

Assays for androgens were made in spayed colchicine treated rats, according to the method first described by Martins[4] and in Leghorn white capons by the comb method. With a total dose of 10 mg of testicular tissue in 1 cc of arachnis oil, a positive effect was observed in both tests.

Assays for estrogens made by the Bülbring and Burn technic,[5] with estrone in parallel, gave a concentration of 2,000 estrone units per kg of fresh ovaries, a value in accord with that mentioned by Fraenkel and Martins.[6] Tests on capons for possible androgens in ovarian extract after estrogenic separation were negative.

As Porto,[7] also in this laboratory, found progestational substances in the corpora lutea of the same *Crotalidae*, we can say that gonads of those snakes contain the three kind of sexual hormones.

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NAMES, RUSSIAN AND OTHER

THE note by Dr. Hrdlička on "Russian Names" (in SCIENCE of March 12) raises a point in a problem of

[1] E. Allen and E. A. Doisy, *Jour. Am. Med. Assn.*, 81: 819, 1923.
[2] Th. Martins and A. Rocha e Silva, *C. R. Soc. Biol.*, 102: 485, 1929.
[3] C. R. Moore, T. F. Gallagher and F. C. Koch, *Endocrin.*, 13: 367, 1929.
[4] Th. Martins, *C. R. Soc. Biol.*, 126: 131, 1937.
[5] E. Bülbring and J. A. Burn, *Jour. Physiol.*, 85: 329, 1935.
[6] L. Fraenkel and Th. Martins, *Mem. Inst. Butantan*, 13: 393, 1939.
[7] A. Porto, *Mem. Inst. Butantan*, 15: 27, 1941.

wider scope which I have thought for some years was in need of elaboration. The rendering of words from a language in which the Latin alphabet is not used into English, has become a source of great confusion. Too often a rendering into French or German is simply transliterated into English, and the values of the letters are then different from the common English sounds; so that without a key the reader is at loss. I do not know what languages our English spellings of Chinese words were transliterated from; but certainly without a key to tell one that, for example, *Chiang* is pronounced approximately *Jang,* and that *Tao* is sounded *Dow,* one would be misled. An entertaining example is the literal taking over of the French spelling of the Arabic word for mountain: *Djebel.* Of course the *D* is essential in French but redundant in English, since the English *J* has the sound which can be written in French only by *Dj.* This has made some radio commentators comic. The appalling confusion in English renderings of Sanscrit words is well known to Sanscrit scholars.

Our English spellings of Russian words appear to be transliterations of German renderings, and these transliterations are often absurd. In "Pawlow," the *w,* as Dr. Hrdlička points out, does not indicate the usual sound of the letter in English: and this spelling has misled many students. Since we do not use the Russian alphabet, and the Russian letter which Dr. Hrdlička calls "v" is not the English *v* why not be sensible and write *Pavloff?* After all, English is a language in its own right.

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SCIENTIFIC BOOKS

THE SCIENCE OF WORDS

Webster's Dictionary of Synonyms. 1st edition. A Dictionary of Discriminated Synonyms, with Antonyms and Analogous and Contrasted Words. xxxiv + 907 pp. Springfield, Mass.: G. and C. Merriam Co. 1942. $3.50 ($4.00 with thumb index).

THERE are a great many obstacles to precision in writing. Many writers, for example, seem to have personal prejudices against certain words and irrational predilections for others—attitudes passed on to them perhaps by some pedantic schoolmaster or half-cocked editor. Others have a leaning toward polysyllables, clothing their ponderous brain children with even more ponderous diction, until their sentences drag along like dull overladen beasts of burden. Still others boast that they never use a "big" word if they can find a "little" one, ascribing some specious virtue to the monosyllabic word *per se.* There are some, too, who in their writing adhere so literally to Pope's well-meaning but dangerous injunction—

> Be not the first by whom the new are tried,
> Nor yet the last to lay the old aside.

—that their vocabulary reminds one of a crowded room with all the windows shut and barred. Precision is attained, once wrote Ambrose Bierce, "by choice of the word that accurately expresses what the writer has in mind, and by exclusion of that which either denotes or connotes something else. As Quintilian puts it, the writer should so write that his reader not only may, but must, understand." To achieve that, the writer must make use of the English language in all its motley, big words and little, new and old.

That is why, I believe, it would be a fine thing if this new Dictionary of Synonyms were available to every scientist in the land, for sooner or later scientists become writers, and whether they know it or not they must be students of semantics. Any work of scholarship that helps them in their quest for exactitude, whether in the science process itself or in the communication of knowledge, becomes indispensable.

The book itself is an entirely new work, written chiefly by Miss Rose F. Egan, assistant editor on the permanent staff of the G. and C. Merriam Company. Mr. Hubert P. Kelsey wrote many of the articles on scientific terms. Articles dealing with law, chemistry and medicine were reviewed, respectively, by Dr. Roscoe Pound, of Harvard University; Dr. Austin M. Patterson, of Antioch College; and Dr. Esmond R. Long, director of the Henry Phipps Institute.

A brief account of the plan of the book will here suffice. Four categories of words are distinguished, as follows:

(1) Synonyms. A synonym is defined as "one of two or more words in the English language which have the same or very nearly the same *essential* meaning"; it is assumed, of course, that an absolute synonym rarely if ever occurs. Furthermore, not all the words discriminated are synonyms. "A few articles discuss a group of words that are sometimes wrongly taken as synonyms because they are confused or their actual meanings are misunderstood or because they once had one or more meanings which made them synonymous."

(2) Antonyms. An antonym is defined as "a word so opposed in meaning to another word, its equal in breadth or range of application, that it negates or nullifies every single one of its impressions."

(3) Analogous words.

(4) Contrasted words.

Thus, under the word *malign,* although the words *malign, traduce, asperse, vilify, calumniate, defame,*

slander and *libel* are considered synonymous, a whole column is devoted to explaining and illustrating the distinctions between them. Analogous words in this case are: *detract from, decry, disparage, depreciate, derogate from, vituperate, revile, defile, pollute.* The antonym is *defend.* Contrasted words: *vindicate, justify, maintain, extol, eulogize, praise.* Some of these words are cross-referenced to other articles where further information is presented.

The Dictionary is well up-to-date. Under the article on the word *drunk,* for example, one finds this comment: "There are many slang terms that imply intoxication: most of them, such as *spiflicated* (or *spifflicated*), *soused, lit,* and *blotto,* are strong in their implications, suggesting loss of powers of locomotion, recognition, speech, and the like."

An indication of the careful and scholarly way in which the various words are distinguished is the wealth of illustrative citations from English and American literature, ancient and modern. Under the word *malign* again, no less than eleven quotations are included to illustrate differentiations in meanings of the synonyms, the authors ranging from classical English writers—Shakespeare, Burke, Scott, Meredith, Tennyson—to such contemporary writers as John Buchan and Van Wyck Brooks. An impressive list of all the authors quoted (at least 1,000, with full names and dates) is appended. Another feature of the Dictionary is the introductory "Survey of the History of English Synonymy," an informative and fundamental chapter for any one interested in the science of words or who wants to know how this dictionary differs from its predecessors. Typographically, the book has been punctiliously put together, the result being an unusually clear and readable page. The main text is printed in 7-point monotype Binney on an 8-point body, double column.

Although precision may be the chief objective for any writer who treats of philosophical subjects, the scientist who tirelessly expands his vocabulary and becomes increasingly sensitive to the subtleties of language will find that perspicuity is not the only reward. He will find himself developing also a richness of style to enhance his expression. He will find that where he used to repeat the same word two or three times in a single sentence, there will spring to his mind half a dozen others to choose from. He will discover himself spending quarter-hours at a time searching for the right word. And when he has finished his sentence, his chapter, his book, he may truly realize what is meant by the old apothegm, "Easy reading, hard writing."

Besides which, for every writer, whether he be scientist, historian, novelist or poet, there is a peculiar artistic satisfaction in having said (if indeed he ever does) exactly what he set out to say. Every writer worth his salt has fallen in love with words, and he woos them ardently. This new Dictionary of Synonyms, whose publication seems to me a real event, should help to "marry off" many an elusive word to "her" new master.

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AUTONOMIC REGULATIONS

Autonomic Regulations. Their Significance for Physiology, Psychology and Neuropsychiatry. By ERNST GELLHORN. New York: Interscience Publishers, Inc. 373 pp. 80 figs. 1942.

INTERRELATIONS of organ systems is attracting the attention of physiologists more and more as the knowledge of the nervous and endocrine systems increases. The study of the organism as a whole is the ultimate goal.

In the present work, "those organs which are influenced by the autonomic system and affect it in turn are subjected to a physiological analysis. Consequently, the relationship between hormones and the autonomic nervous system is investigated." The mutual relation between the autonomic and somatic nervous systems is discussed. It is shown that the autonomic system is afferent as well as efferent, influencing the excitability of the somatic system. An analysis of emergency conditions indicates that the vago-insulin system, as well as the sympathetic-adrenal system, is involved.

This book evolved as a result of lectures and research during the past nine years. The great amount accomplished by Gellhorn and his associates is indicated by the fact that three fourths of the figures are from his laboratory. However, the large number of references (1,100) shows that he has drawn freely on the work of other investigators.

Approximately the first third of the book is devoted to adjustment reactions involving primarily the respiratory and circulatory systems in response to carbon dioxide, anoxia, asphyxia, hemorrhage and hypoglycemia with a chapter on the regulation of cerebral circulation.

This is followed by discussions of the nervous regulation of the hypophysis and the role of the sympathetico-adrenal and vago-insulin systems.

The next part deals with autonomic-somatic integration. The role of the sympathetic and parasympathetic systems in anoxia, hypoglycemia and hemorrhage is covered in one chapter, while a second chapter deals with the differences in the reaction of the autonomic and somatic nervous systems and a third is

concerned with the relation between these two systems and its significance in convulsions. The fourth chapter of this part is on the autonomic basis of emotion.

The last part, on results and applications, begins with two very good chapters on the principles of autonomic organization and on organismic physiology. There is a chapter on anesthesia, and one headed "The autonomic nervous system and neuropsychiatry," which is an attempt to analyze the effects of various procedures used in the treatment of schizophrenia. A good summary at the end of each chapter is helpful to the reader. The book is a distinct contribution to the literature.

FRANK A. HARTMAN

REPORTS

GENERAL COUNCIL ON ZOOLOGICAL NOMENCLATURE

THE undersigned zoologists, resident in the United States of America, at the invitation of the Committee on Nomenclature of the American Society of Mammalogists and with the cooperation of the "American Commission on Scientific Nomenclature" of the Entomological Society of America, do hereby associate themselves together as a society and certify as follows:

First: The name of the society shall be the General Council on Zoological Nomenclature.

Second: The objects of the society shall be:

(A) To act in an advisory capacity in all matters concerning zoological nomenclature during the World War and for such time thereafter as it may consider desirable.

(B) To administer, amend, interpret, and maintain a code of nomenclature for the use of zoologists.

(C) To cooperate with societies maintaining committees on nomenclature, at least those represented in its own membership.

(D) To retain within itself important powers of decision and legislation and of substitutions and additions to its membership, but always subject to full hearings and the advice and counsel of one or more of the committees above mentioned.

(E) To cooperate with zoologists practised in nomenclature who are residents of foreign countries when the war is ended or as soon thereafter as may be practicable.

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A. WETMORE

Merely on the face of it, the above may seem to be a self-constituted body of dubious possibilities and audacious construction. That this is not the case may be evident when its history and purposes are explained. It is the outgrowth of numerous informal discussions among a large number of zoologists during the past few years and of formal action taken by at least two national societies.

Even in years just prior to the war, the International Commission on Zoological Nomenclature was relatively inactive and after hostilities began in Europe in 1939 it became practically non-functional. This created a situation in which all cooperative action was endangered and nearly a century's hard-earned progress in nomenclature was threatened. Individuals and organizations began to discuss special codes for their separate groups only and in some cases took definite action. Recently a German (Poche) has promulgated a code of his own and in general at the moment every zoologist having a nomenclatural problem finds himself without appeal to any constituted authority. It was precisely to avoid this condition that codes and commissions were devised.

Discussion among zoologists unanimously recognized the emergency, but it was difficult to arrive at a basis for action which did not involve very great delay and long-drawn controversy. There were those who felt that the international idea could not be abandoned and others who advocated complete divorce from the Old World. The latter pointed to the success of the International Commission as being mainly due to the American, C. W. Stiles, whose final conclusion (see SCIENCE, 73: pp. 349–354, 1931) was that it was not further workable. Among those holding this opinion were several Europeans.

As announced in SCIENCE (June 12, 1942) the Entomological Society of America, pursuant to action taken at its meeting in December, 1941, formed an "American Commission on Scientific Nomenclature in Entomology" apparently with the object of proceeding independently. Somewhat later at its annual meeting in April, 1942, the American Society of Mammalogists instructed its standing committee on nomenclature "to act pro-tem in the present world crisis for the Committee [sic] on Nomenclature of the International Commission." The Mammalogists' committee felt that any committee restricted to a particular branch of zoology would be ineffective. Therefore, with the approval of the society's president and principal directors, this committee entered into correspondence with the entomologists proposing that the two committees, without further authorization, jointly

* Dr. Simpson's signature is assumed on the basis of his verbal agreement before he left for war service where he can not now be reached.

sponsor the selection of a small group of representative nomenclaturists to "take over," at least for the time being. Full cooperation between the two committees proved impractical without great loss of time, so the Mammalogists' committee, after receiving the approval of the majority of the entomologists, selected and organized the group as indicated above. The membership of the Mammalogists' committee which carried this out was as follows: A. Cabrera, E. R. Hall, G. S. Miller, Jr., W. H. Osgood, T. S. Palmer, G. G. Simpson and G. H. Tate.

The "Council" thus formed is frankly experimental and the method of its genesis is unusual, but those responsible for it have felt that any other method, especially in these times when large general meetings are interdicted, would defeat itself in prolonged discussion and fatal delay. Under restrictions which the Council has placed upon itself it is hoped that it may be a wholly representative and cooperative body. A brief set of by-laws has been adopted in which important provisions are to the effect (1) that the active membership shall not exceed fifteen, (2) that additions and replacements shall be made only from candidates nominated by large associations of zoologists and (3) that no important action can be taken without first obtaining the opinion of at least two nomenclatural committees of national societies and several individuals not members of the Council. A judicial function is thus implied preceding any legislation.

It does not propose to supersede any existing special nomenclatural committees, but on the contrary it is designed to stimulate them to greater interest and more action. Its post-war status is problematical, but at least as a temporary measure and an effort in a direction urgently needing attention, it is hoped it may find support. At an early date it is proposed to increase the membership from nine to eleven in order to cover important branches of zoology which are not now well represented.

The by-laws giving details of proposed action will soon be available for distribution to any interested zoologists who may apply for them.

WILFRED H. OSGOOD,
Secretary

SPECIAL ARTICLES

ISOLATION OF THE ANTIANEMIA FACTOR (VITAMIN Bc) IN CRYSTALLINE FORM FROM LIVER*

SOMETIME ago Hogan and Parrott[1] pointed out that under certain dietary conditions chicks fail to grow, and develop a severe anemia which can be cured with liver extracts. They recognized the responsible factor as being an unidentified member of the B complex and for convenience designated it vitamin Bc. O'Dell and Hogan[2] developed an assay procedure with chicks, and succeeded in concentrating the factor in crude liver extract about sixty-fold.

In the fall of 1940 we undertook the isolation of this vitamin. We have recently succeeded in obtaining the compound in pure form. It crystallizes from water in orange-colored spherulites which exhibit typical parallel crossed extinction. After repeated recrystallization it separates in clusters of thin yellow spear-head shaped platelets.[3] It does not melt below 360° C. but darkens and chars from about 250° C. Analysis of an ash-free specimen gave the following percentage composition: C 50.50, 50.63; H 4.78, 4.78; N 19.91.

The compound yields a crystalline methyl ester which has no melting point, contains less than 5 per cent. of the activity of the original acid and can be converted back to the crystalline acid.

When the crystalline acid is administered to day-old chicks on a prophylactic test[4] at a dosage level of 2.5γ per gram of deficient ration the chicks grow normally and at the end of 4 weeks exhibit no anemia. Studies under way will establish the minimum dosage level necessary. The data in Table I summarize the

TABLE I

BIOLOGICAL RESPONSE TO CRYSTALLINE VITAMIN Bc

	No. of chicks	Level per gm of ration	28-day test: Hgb. gm 100 cc	28-day test: Per cent. Hematocrit	28-day test: Weight (gm)
1. Basal ration (negative controls)	127	...	5.51*	14.2	75.8
2. Broiler ration (positive controls)	18	...	....	27.7	169.5
3. Basal ration + crude concentrate	16	0.18 cc	9.90*	29.7	191.1
4. Basal ration + semi-pure fraction	4	5.0γ	....	32.5	198.5
5. Basal ration + vitamin Bc (crystals)	9	2.5γ	10.95*	30.1	196.3

* Number of chicks tested was 11, 6 and 6, respectively.

results of a preliminary demonstration of its potency on the chick.

* This article was received for publication on April 8, 1943.

[1] A. G. Hogan and E. M. Parrott, *Jour. Biol. Chem.*, 132: 507, 1940; 128: Proc. xlvi, 1939.

[2] B. L. O'Dell and A. G. Hogan. In press.

[3] A complete crystallographic description will be given later by Professor C. B. Slawson, of the University of Michigan.

[4] The details of this method will be published elsewhere by Mr. C. J. Campbell, whose valuable assistance on the animal assay work is hereby acknowledged.

During the course of this work Mills, Briggs, Elvehm and Hart[5] reported that a concentrate from liver epresenting Peterson's "eluate factor"[6] was potent s a growth factor in chicks and that it also prevented e development of anemia (low hemoglobin). On the sis of the above observations these authors suggested at Hogan's antianemia factor and Peterson's "eluate ctor" might be identical. They also pointed out e similarity between the two factors with respect to eir alcohol insolubility and adsorbability on Fuller's rth at acid pH levels. Following the appearance of is publication, we assayed our concentrates of the ntianemia factor by the microbiological growth ethod and found them to be highly active in growth ctor activity for *Lactobacillus* ε (Peterson's "eluate ctor"). The repeatedly recrystallized vitamin proces approximately half-maximum growth of *Lactocillus casei* ε in a concentration of 0.00005γ per cc culture media. These observations demonstrate conusively the identity of Hogan's antianemia factor nd Peterson's "eluate factor."

Likewise, during the course of our isolation work on e antianemia factor, Mitchell, Snell and Williams[7] eported the preparation of a concentrate from inach which was very active in stimulating the owth of *Streptococcus lactis R.* or *Lactobacillus sei* ε in comparable dosage. They expressed the inion that they had "what appears to be a nearly re chemical entity." They stated that it contained nitrogen, no sulfur or phosphorus and had a molecular weight of 500 as determined by diffusion methods and suggested the name *folic acid* for this microbiological growth factor. Peterson[4] has discussed the probable identity of his "eluate factor" with the "folic acid" factor of Williams. It appears probable that the chick antianemia factor, Peterson's "eluate factor" and Williams' "folic acid" factor are the same. We shall discuss later the chemical identity of the chick antianemia factor from animal with that from plant sources.

Since Hogan and his collaborators discovered the vitamin nature of the chick antianemia factor in liver[1,2] and applied the convenient designation vitamin Bc, we propose the retention of this term for the pure crystalline compound from liver until such time as chemical knowledge of the substance may suggest a more suitable name.

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[5] R. C. Mills, G. M. Briggs, Jr., C. A. Elvehjem and . B. Hart, *Proc. Soc. Exp. Biol. and Med.*, 49: 186, 1942.
[6] B. L. Hutchings, N. Bohonos and W. H. Peterson, *our. Biol. Chem.*, 141: 521, 1941; E. E. Snell and W. H. eterson, *Jour. Bact.*, 39: 273, 1940.
[7] H. K. Mitchell, E. E. Snell and R. J. Williams, *Jour. m. Chem. Soc.*, 63: 2284, 1941.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

QUANTITATIVE MICRO-ESTIMATION OF ANTIBODIES IN THE SERA OF MAN AND OTHER ANIMALS[1]

Quantitative micro-methods for the determination f antibody nitrogen, conforming to the rigid criteria f analytical chemistry and involving the use of the icro-Kjeldahl or Teorell procedures have been availble for some years.[2, 3, 4] These methods reach their greatest degree of accuracy with quantities of antibody nitrogen ranging from 0.1 to 1 mg. There is need, however, for a procedure which could be carried out with one fifth to one tenth these amounts, particularly in the case of human sera, in which the antibody content in health, immunity or disease is not likely to be large. The present method, developed to meet this need, has been in use in this laboratory for more than a year and has consistently yielded reproducible results. The principal departures in technique from the earlier method are precautions to ensure sterility during the relatively long period before the precipitates are washed, and colorimetric estimation of the nitrogen. Depending upon the results of preliminary tests three 1 to 4 ml portions of serum are used.

Use of the Folin-Wu-Ciocalteau phenol reagent for the estimation of proteins was advocated by Wu,[5] developed by Anson,[6] rendered more sensitive by Herriott[7] through the addition of minute amounts of copper ion, and further adapted to micro-analysis by

[1] From the Department of Medicine, Columbia Univerty, College of Physicians and Surgeons, and the Presbyrian and Babies Hospitals, New York City. Aided in rt by a grant from the Commonwealth Fund.
[2] M. Heidelberger and F. E. Kendall, *Jour. Exp. Med.*, : 809, 1929; M. Heidelberger, R. H. P. Sia and F. E. endall, *Jour. Exp. Med.*, 52: 477, 1930.
[3] M. Heidelberger, F. E. Kendall and C. M. Soo Hoo, our. *Exp. Med.*, 58: 137, 1933; M. Heidelberger and F. Kendall, *Jour. Exp. Med.*, 61: 559, 1935; M. Heidelrger and E. A. Kabat, *Jour. Exp. Med.*, 60: 643, 1934.
[4] M. Heidelberger, F. E. Kendall and T. Teorell, *Jour. xp. Med.*, 63: 819, 1936.
[5] H. Wu, *Jour. Biol. Chem.*, 51: 33, 1921.
[6] M. L. Anson, *Jour. Gen. Physiol.*, 22: 79, 1938–39.
[7] R. M. Herriott, *Proc. Soc. Exp. Biol. Med.*, 46: 642, 1941.

Altschul.[8] Washed specific precipitates containing as little as 1 γ of N yield a definite blue color by the modified method and this may be read in a photoelectric colorimeter or a spectrophotometer[9] at λ = 650.

Since heat-inactivation may damage antibody in weak antisera,[10] complement, which may add nitrogen to certain specific precipitates,[11] is removed by addition of an antigen and the corresponding rabbit antibody unrelated to the immune system to be analyzed. These may be added either separately or in the form of finely divided specific precipitate suspended in saline. For analyses of antibodies to pneumococci of many types and influenza bacilli, egg albumin (Ea) and rabbit anti-Ea are used in this preliminary step. After centrifugation of the Ea-anti Ea precipitate the supernatant is divided into three equal portions, one of which serves as a blank. To the other two a slight excess of specific polysaccharide (usually 0.005 to 0.02 mg, as indicated by the preliminary tests) is added and the serum and solution are thoroughly mixed. Conical centrifuge tubes of about 8 ml capacity are convenient to use. After one half to one hour at 37° C the tubes are placed in the refrigerator for a week or ten days. Centrifugation and washing in the cold are carried out as in previous papers.[3, 4] The blanks and precipitates are then taken up in water, treated with 0.2 to 0.3 m of 0.1 *N* NaOH until the precipitates are dissolved, and made up to 2.5 ml or more, depending upon the amount of precipitate. Aliquots of 2.0 ml are mixed with 6 ml of clear 12.5 per cent. Na_2CO_3 solution and allowed to stand for 1 hour to ensure maximum color development later. 1 ml of Folin reagent freshly diluted with two parts of water is then added. After 20 to 30 minutes the duplicates may either be read directly against the blank, with the latter set at 0 optical density or 100 per cent. transmission, or all tubes are read against a blank of 2 ml of water to which the above reagents have been added. Optical densities are read and converted into antibody N by means of a factor obtained with known amounts of antibody N. The optical density is proportional to the amount of antibody N, but may differ for antibodies of the different animal species and may not be the same as that of normal globulin. Indicated differences in the color values will be studied in greater detail. Table I gives representative analyses carried out by earlier modifications of the method differing in detail.

TABLE I

Species, Serum Volume	Specific polysaccharide and amount used	Optical density*	Factor for conversion to N	Factor for calculation of aliquot to standard vol.	Antibody N per 4 ml serum
ml		*mg*			*mg*
Man, 4.5	Pneumococcus "C,"	0.02	0.320	0.0642	1.445	0.030
" "	" III,†	0.01	0.118	0.0642	1.2	0.008
Horse, 0.5	" "C,"	0.015	0.497	0.0746	10	0.371
Rabbit, 1 (1:10)	*H. influenzae,* B,	0.007	0.522	0.0698	66.8	2.44

* Negative logarithm of transmittance.
† After preliminary absorption with "C" substance.

A more detailed account of the method, its possibilities and its limitations is in preparation.

Summary

A micro-method is described by which as little as 10γ of specific precipitate nitrogen may be determined with a fair degree of accuracy. The error in repeated determinations is about ± 2γ.

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[8] A. M. Altschul, personal communication.

[9] A Coleman Universal spectrophotometer was used in these studies.

[10] Unpublished experiments in this laboratory.

[11] (a) M. Heidelberger, *Jour. Exp. Med.*, 73: 681, 1941; (b) M. Heidelberger and M. Mayer, *Jour. Exp. Med.*, 75: 285, 1942.

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